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The Gale of October 18th–20th, 1935

By T. W. V. JONES, B.Sc.

The gale which swept the British Isles on October 18th, 19th and 20th, 1935, was noteworthy both for its violence, especially in Scotland, and for the time of year at which it occurred. Although deep depressions accompanied by winds of gale force are quite common in the British Isles during the winter months, it is rather unusual to experience gales of extreme violence during the month of October; and the wind velocities which were measured during this particular storm would have been exceptional for any time of the year.

The cause of the gale was a very large and intense depression, with extremely low pressure at the centre, which moved from a position south of Iceland across the north of Scotland to the Baltic, deepening as it travelled across Scotland. The average rate of travel of the depression was about 30 m.p.h. At 7 a.m., on Saturday, October 19th, the centre of the depression was almost exactly over Wick, and the pressure recorded there at that time was 952·6 mb.

During the night of October 17th–18th, the British Isles were under the influence of a feeble ridge of high pressure, the northern extension of an anticyclone centred on the Atlantic about 500 miles eastward of the Azores. In general, the night was fair with moderate westerly winds, and a slowly rising barometer.

The first indications of the oncoming depression were given at 7 a.m., on October 18th, when pressure began to fall in the west of

the country and the wind backed to S. or SW. on the north-western and western coasts. By 10 a.m., it was obvious that the approaching depression was of considerable intensity ; in three hours the pressure had fallen 6 mb. at Malin Head on the northern Irish Coast, continuous rain had commenced at Stornoway and the wind on the north-western and western coasts had become generally southerly and fresh or strong ; and on the extreme west coast of Ireland had already reached gale force. By 1 p.m., further large falls of pressure had taken place (10 mb. in three hours at Stornoway) and rain had spread to the whole of northern and western Scotland.

During the rest of the day and night the wind continued to increase over the whole of the British Isles ; and the direction which had been mainly southerly or south-westerly became westerly as the depression moved eastward. At 9 p.m., in the evening a wind of Beaufort force 9 (50 m.p.h.) was reported from Eskdalemuir, in Dumfriesshire. At 1 a.m. on the 19th winds of gale force or above were general over the whole country both inland and on the coast, with the exception of the extreme south and east. During that night and the early hours of the morning winds of Beaufort force 9 or above were reported from Pembroke, Point of Ayre (Isle of Man), Stornoway, Blacksod Point, Sealand and Abbotsinch.

Throughout Saturday, October 19th, the depression continued to move away in an easterly direction but the pressure gradient in the rear of the depression was very steep and the gales continued, if anything with increased force, over most of the country, the wind being more gusty and squally owing to the supply of polar air which gradually spread over the whole of the British Isles, from a direction between west and north-west. The rise of pressure in the rear of the centre of the depression as it moved away was of course very rapid ; in the three hours between 3 p.m. and 6 p.m. on the 19th the pressure rose 8·0 mb. at Stornoway.

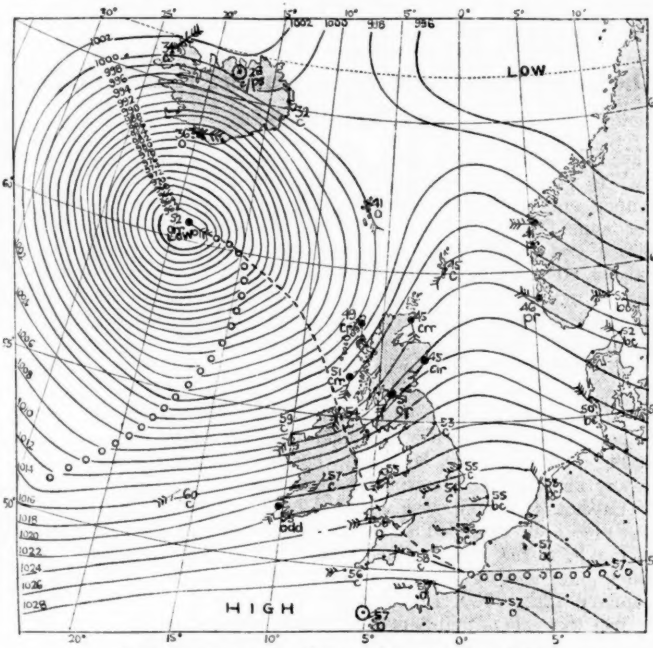
By 7 a.m., on Sunday morning, October 20th, the centre of the depression was situated over southern Sweden and although winds of gale force were still being reported from a number of coastal stations in the north of the British Isles the winds were quickly moderating and by midday had veered almost to north and were not more than fresh in force.

As would be expected with a vigorous and deepening depression of this type there was at first a well marked warm sector. The warm front reached the western coasts during the forenoon of October 18th and passed across Ireland and Scotland during the day ; the cold front, behind which a marked veer of wind took place, was lying roughly down the western Scottish and western Irish coasts at 6 p.m. on the 18th and passed across the country during the evening and night, moving considerably faster than the warm front ; so that by the morning of Saturday the 19th, the central part of the depression was occluded.

Amongst the highest gusts recorded by anemometer stations during the gale were the following:

Abbotsinch	92 m.p.h.	Manchester	73 m.p.h.
Holyhead	76 m.p.h.	Eskdalemuir	69 m.p.h.
Pembroke	73 m.p.h.	Boscombe Down	61 m.p.h.
Sealand	73 m.p.h.		

The very great fall of pressure which accompanied the passage of the centre of the depression is well illustrated by the fact that at 1 a.m. on Friday, October 18th, the barometer reading at Wick was 1013·7 mb.; while at 7 a.m. on the 19th the pressure recorded there was 952·6 mb.; a fall of 61 mb. in 30 hours.



SYNOPTIC CHART 13H. FRIDAY, OCTOBER 18TH, 1935

The rainfall measured during the period of the gale was in most places not exceptional; although amounts exceeding 1 in. were recorded during the 48 hours ending at 7 a.m. on October 20th at some stations in Scotland and northern England; and at Dalwhinnie during this period the total fall amounted to 60 mm. (2·36 in.)

Shipping suffered severely from the storm; and undoubtedly the greatest tragedy was the loss of the Glasgow Steamer *Vardulia* with

her crew of 37. This ship had to be abandoned in a sinking condition on the night of October 19th, about 400 miles west of the Hebrides; and although an intensive search for her boats was carried out by a number of vessels for several days, no trace of them could be found. Two coasters were driven ashore in the Clyde and another grounded in the Tay, whilst according to *The Times* of October 22nd, the estimated damage to small craft at Clyde resorts was about £50,000. Structural damage was reported from all parts of the country; but more especially from Scotland and northern England, and in Scotland communication was considerably interrupted owing to damage to telephone and telegraph lines. A number of persons were killed or injured as the result of accidents attributed either directly or indirectly to the gale.

The Exceptional Gales of September 16th–17th, 1935

By L. F. Lewis, B.Sc.

The gale which raged over southern England from September 16th to 17th, 1935, was exceptionally severe for the time of year. Among notably high speeds recorded in gusts were 98 m.p.h. at Pendennis Castle, 96 m.p.h. at St. Mary's, Scilly, 92 m.p.h. at The Lizard and at Manston, 88 m.p.h. at Cardington, 81 m.p.h. at Calshot, 80 m.p.h. at Larkhill (Salisbury Plain), 77 m.p.h. at Lympne and 72 m.p.h. at Dover. The writer has examined the analysis of the anemograph records for the above stations published in Tables XI and XV of the *Annual Summary to the Monthly Weather Report* back to 1920 (or to the year in which the analysis was first published, if the instrument was installed at a later date) and has not found in any September, speeds comparable with those mentioned above. In some cases the speed is the highest ever recorded: for example, at Larkhill* the speed, 80 m.p.h., has not previously been reached in any month since the wind analysis was first published in 1921; at Calshot, 81 m.p.h. was equalled on December 29th, 1929, but has not been exceeded since at least before 1921 and at Dover† 72 m.p.h. is the highest since before 1924. The speeds at Scilly (96 m.p.h.) and at Pendennis Castle (98 m.p.h.) were exceeded on January 12th, 1930, December 6th, 1929 and March 8th, 1922. In fact this gale of mid-September, 1935, was comparable with some of the most severe winter gales ever experienced in southern England.

The gale was very destructive both on land and sea. Telegraph wires were broken down, hundreds of trees were felled and extensive damage was done to vegetation of all kinds. Much correspondence has been published in *The Times* with reference to the cause of the

* The instrument at Larkhill was not in operation during the stormy period of November, 1929 to January, 1930.

† The instrument at Dover was defective during the gales of November, 1928.

destruction of the leaves on the trees. Some writers believe that it was due to the deposit of salt carried by the wind but others (including Dr. Vigurs of Newquay) believe that the injury was due to the actual mechanical beating of the wind and of the leaves one against another. At sea, many ships were wrecked and some lives were lost both on land and sea.

It is interesting to find that on the occasion of each of the noteworthy gales of March 8th, 1922*, December 6th, 1929†, January 12th, 1930‡ and September 16th-17th, 1935, the prevailing pressure distribution was similar. In each case a depression was situated off north-west Scotland, while a secondary development occurred off our south-west coasts. The latter disturbance became intense and moved north-east or east-north-east across England, giving rise to the exceptionally high wind speeds experienced.

An interesting effect of the gale of September 16th–17th was the deposit on windows in Cornwall. The deposit was very thick and was sometimes described as grey and sometimes dark brown. The trajectory of the air which was at Scilly at 1 a.m. on the 17th has been traced and before reaching Cornwall the air travelled more than 500 miles across the North Atlantic. This fact rules out the possibility of the deposit coming from either a desert or the industrial areas of England. White or greyish deposits were probably salt carried by spray after the heavy rain had ceased. Transport of salt in this way is well known. The brown deposit presents more difficulty but the most likely suggestion seems to be that it consisted of oil or other waste scum brought in from the sea. It is said that the coastguards at St. Ann's Head are sometimes covered with oily filth when spray is carried over by strong westerly winds.

OFFICIAL PUBLICATION

The following publication has recently been issued :—

GEOPHYSICAL MEMOIRS.

No. 67. *Some measurements of the variation of potential gradient with height near the ground at Kew Observatory.* By F. J. Scrase, M.A., B.Sc. (M.O. 356j.)

This memoir describes some observations of the variation of potential gradient up to a height of 10 m. made by a differential method employing a double stretched-wire collecting system. It was found that on the average the potential gradient decreased by about three per cent. in 10 m.; the change was more uniform in turbulent air than in comparatively stagnant air. On the average the density of the volume charge was small enough to be accounted for by the normal excess of positive small ions. In still air a charge of the order of + 0·1E.S.U./m.³ was observed between 5 and 10 m. and it is

* See *Meteorological Magazine* **57,** 1922, p. 102.
† *Ibid* **64,** 1929, p. 280. ‡ *Ibid* **65,** 1930, pp. 1–6.

probably the large ions which are effective in such conditions; the necessary excess of positive large ions is, however, so small compared with their total number that for most purposes we may regard positive and negative to be equally numerous.

Discussions at the Meteorological Office

The subjects for discussion for the next two meetings are :—

November 25th, 1935. (a) *The size and size distribution of fog particles* and (b) *A study of the evaporation of small water drops.* By H. G. Houghton (Physics, Minneapolis, Vol. 2, 1932, pp. 467–75; and Vol. 4, 1933, pp. 419–24.) *Opener*—Mr. S. F. Witcombe, B.Sc.

December 9th, 1935. *Practical experiences and some results gained from soundings with registering balloons and registering apparatuses in the stratosphere.* (Beitr. Phys. frei. Atmos. Leipzig, Vol. 22, 1935, pp. 249–60.) *Opener*—Mr. F. J. W. Whipple, Sc.D.

Correspondence

To the Editor, *Meteorological Magazine*

An unusual Optical Phenomenon. An Arc of Lowitz?

I am enclosing an account of an optical effect observed by my father, who was at Grayshott at the time, on August 28th last.

At 17h. 40m. the west and north-west sky contained a considerable amount of cirrostratus cloud, of which the structure was only faintly perceptible. On a horizontal line through the sun, to the north of it, in the place where one would expect a parhelion of 22°, a "shaft" of light was visible. It was vertical. Its length was about 2°–3°; its width probably less than 1°. It possessed iridescent colours, well defined but not brilliant. It could not have been part of the halo of 22° as it showed no curvature whatever—it was perfectly straight.

My father said it was an elongated parhelion, but I am inclined to think that he had been favoured with the rare chance of seeing an arc of Lowitz, since the distortion took place vertically, and not in the direction of the parhelic circle. The arc of Lowitz must have been out of shape—in fact Besson ("Sur la Théorie des Halos") states that this rarely takes the proper shape of a double fan of light, but is generally seen as a distorted parhelion.

S. E. Ashmore.

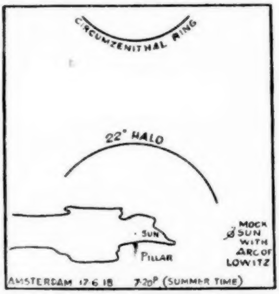
Field Cottage, Llanishen, Cardiff, September 18th, 1935.

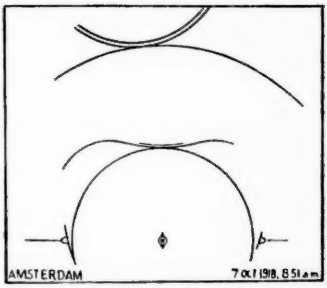
[The observations recorded by Mr. Ashmore remind me of a phenomenon which I saw six years ago, on May 22nd, 1929. The note from which the following quotation is taken is dated, in typescript, May 29th, 1929, a week after the event, but the note was, I believe, written with much less delay.

"When I left the Observatory at 18h. 5m. the upper part of a

22° halo was visible but no parhelion. The northern parhelion appeared soon after I got on an omnibus at Richmond. The parhelion was formed in a cloud much lower and denser than that producing the halo and no part of the halo was within a good many degrees of the parhelion. About five minutes later when the omnibus was at Kew Gardens, the parhelion became more brilliant and was drawn out in a band of colour inclined at about 15° to the vertical, the length being considerably greater than the width. The red of this band was much brighter than the dull red of the halo. The band was only visible for about half a minute ; the parhelion persisted for ten minutes, though growing fainter."

The arcs of Lowitz were observed in Holland on three days in 1918. Sketches made by a practical observer, Mr. M. Pinkhof, at Amsterdam on two of three days, June 17th and October 7th are reproduced in *Hemel en Dampkring* 1918 and in *Onweders, Optische Verschijnselen, enz in Nederland*, 1918, pp. 67 and 71. The ones in the latter publication are reproduced again here. The first





Reproduced from Onweders, Utrecht, 1918, p. 67 and p. 71

sketch recalls my observation, for only the upper part of the ordinary halo is shown. The arc of Lowitz is shown on the right of the sun, which is hidden by dense cloud. The length of the arc is said to have been about 2°.

On October 17th, 1918, Pinkhof observed a halo complex which included both arcs of Lowitz. The arc on the left was 7° long, it passed through the parhelion and reached the halo. It is not stated whether the arc was straight or curved. It is clear, however, that these arcs should not be regarded as touching the halo. In the drawing made by Lowitz at St. Petersburg in 1794 the arcs now known by his name meet the halo at an angle.

The theory referred to by Mr. Ashmore is obviously at fault for the arcs when seen are well defined. There is, I think, good reason for calling the phenomenon seen by Mr. Ashmore, Senior, an arc of Lowitz even though this may be the first time that a vertical arc has been recorded.—F. J. W. WHIPPLE].

Cirrus Cloud at an unusually Low Altitude

Shortly before 8h. B.S.T. on October 2nd, 1935, I observed here some cirrus cloud which seemed to be at an unusually low altitude.

At that time there were about 5/10ths of altocumulus covering most of the sky west of a line from north to south. Below this cloud, which appeared to be of typical altocumulus structure but with considerable shading, was a small amount of cirrus uncinus to northwestward with a radial point in the west. Both this cloud and the altocumulus seemed, as far as I could judge, to be moving from north-west and at about the same speed. The snowy-white cirrus uncinus was clearly distinguishable from the greyish cloud layer above it, and the contrast became sharper as some of the cirrus cloud reached the zenith.

At 10h. the altocumulus had covered about 7/10ths of the sky and had become darker and thicker. There was then no sign of cirrus below it.

Conditions at the surface at 8h. were: wind westerly, force 2, screen temperature 45°F.

C. Stuart Bailey.

Longbridge, 76, Woodcote Valley Road, Purley, Surrey, October 2nd, 1935.

Irisation

An excellent example of irisation was observed at Cranwell at approximately 15h. on October 15th, 1935.

The cloud at that time consisted of small patches of stratocumulus and altocumulus with considerable cirrus and cirrocumulus, the sky being 7/10ths covered. The particular cloud involved was a patch of cirrocumulus, size about 1/20th of the total sky in view, at 9° north-west of the sun. The whole patch was tinted red, green, blue and yellow and the effect was a beautiful mother-of-pearl. The blue and yellow faded very quickly after the first observation but the red and green remained for some considerable time.

A nephoscope reading taken at the time produced the result 30 m.p.h. at 300°.

L. L. Alexander.

Meteorological Station, Cranwell, October 16th, 1935.

Partial Cloud Dispersal by an Aeroplane

The letters by R. E. Watson and others in the July issue of the *Meteorological Magazine* on " Partial Cloud Dispersal by an aeroplane " recall an incident at this station in about the late autumn or early winter of last year. Late in the afternoon fog suddenly began to develop on the aerodrome. I should estimate it was about 15 ft. deep, when an aeroplane came in to land. Actually although lost to view the pilot did not land at the first attempt, but suddenly came up out of the fog, made a half circle of the aerodrome and then

landed successfully. On inquiry it was discovered that during the first approach the pilot cut a lane in the fog and then returned to make a perfect landing in this clear lane.

The great similarity in the conditions and in the dimensions between the cloud patch mentioned by Mr. Watson and the aerodrome fog here is very striking. I suggest that in these cases where condensation is just commencing through such a very restricted vertical thickness, the airscrew draws in some of the " outer " air which at least is not yet at condensation point (and would in general be somewhat warmer than the fog-laden air) and the condition of the resultant mixture in and around the aircraft is such that, at least temporarily, evaporation replaces condensation. It is suggested that some " outside " air with different characteristics is necessarily involved in these cases of cloud and fog dispersal. If it is assumed that an average airscrew of about 11 ft. diameter affects the air in its path over a diameter about 15 per cent greater, it will be seen that in both the above cases, an adequate supply of " outer " air is assured. Had the cloud at Abingdon been as much as 50 ft. thick, would any partial dispersal of the cloud have occurred if the machine had flown through the centre of it ?

From a study of the opposite effect to dispersal, that of cloud formation by aeroplanes at this station, Mr. J. S. Smith and myself conclude that the turbulence of the slipstream, with the pressure reductions associated with it (in spite of the heat of the exhaust gases), is calculated to form cloud under suitable conditions in a layer of damp air which is of the order of 500 ft. thick, even after cloud which was originally present there has dispersed, as well as in other conditions.

F. H. DIGHT.

Meteorological Station, R.A.E., S. Farnborough, Hants, October 17th, 1935.

Dust-devils

Proof of the comparative frequency of small whirlwinds in the British Isles is their prominence in folk-lore. In Ireland and Scotland they are attributed to the fairies, also in the former country to the dead.

CICELY M. BOTLEY.

Guildables, 17, *Holmesdale Gardens, Hastings, October 22nd,* 1935.

Thunderstorms associated with a Warm Front

The occurrence of a thunderstorm at a well marked warm front of a depression is sufficiently rare to merit an account of the conditions under which it was experienced. Such a thunderstorm occurred at Cranwell from 15h. 46m. G.M.T. on September 24th, 1935.

The weather conditions during the day were as follows :—slight rain commenced at 6h. 25m., and intermittent rain occurred until

10h. 50m. when the cloud base lowered from 1,500 to 600 ft. and the visibility decreased from 2½ to 1¼ miles. From that time slight continuous rain was experienced until the onset of the thunderstorm, the cloud base remaining at 500 ft. although the visibility improved to 2½ miles at 14h. 10m. A thunderstorm developed to the north-west of Cranwell at 15h. 46m. and heavy rain occurred. At 17h. 45m. the clouds began to decrease and rain ceased at 18h. 2m.

Light to moderate winds occurred during the day, the direction being southerly, backing to SE. after 9h., and then veering to southerly after 13h. At 16h. the wind decreased from 11 m.p.h. to less than 5 m.p.h., the direction being variable until 16h. 35m., when it became mainly SSE. with a gust of 34 m.p.h. from WSW. Later the wind gradually veered from southerly at 19h. to westerly at 23h., the force increasing from moderate to fresh. During the day the temperature rose slowly and steadily from 49° at 11h. to 55° at 15h. Little change of temperature occured during the thunderstorm, but later the temperature rose to 57° at 18h. Pressure fell throughout the day, with a temporary check in the fall about 16h. Until the commencement of the thunderstorm about 7mm. of rain were recorded, while from 15h. 46m. to 17h. 45m. about 20 mm. of rain fell.

The upper winds over England were from SSW. to WSW. at 7h. and 13h. but had become WNW. at Holyhead by 17h.

At 13h. a warm front extended from Manchester to west of Calshot and a cold front from Holyhead to Plymouth. At 18h. the warm front extended from Spurn Head down the east coast of England with a cold front from Manchester across Salisbury Plain. Upper air temperatures at Duxford showed a rise from 36° to 44° at 5,000 ft., from 27° to 28° at 10,000 ft. and from 10° to 14° at 15,000 ft. between 6h. and 12h. on September 24th, and falls from 44° to 35° at 5,000 ft., from 28° to 22° at 10,000 ft. and from 14° to 7° at 15,000 ft. between 12h. on the 24th and 6h. on the 25th.

It would appear that the thunderstorm resulted from the incursion of colder air above the warm front in this quickly moving depression.

R. P. Batty.

Meteorological Station, Cranwell, October 23rd, 1935.

Geophysical Memoirs No. 65

Professor Köhler has drawn my attention to an unjustifiable assumption in *Geophysical Memoirs* No. 65. " Transfer of heat and momentum in the lowest layers of the atmosphere."

In order to illustrate the use of " power laws " I have quoted on p. 20 a formula derived by Köhler for the distribution of temperature and have deduced that the variation of time of maximum temperature with height is given by a " power law ". This power law I then compared with a power law found empirically and from

this comparison deduced that the coefficient of eddy conductivity varies as $z^{1\cdot 62}$. The particular formula quoted however, was not established for heights as low as those considered in the memoir and accordingly the final deduction mentioned above, that the coefficient of eddy conductivity varies as $z^{1\cdot 62}$ was not valid.

Nevertheless I think it is still of interest in view of the good agreement with the similar result obtained on p. 27 of the memoir.

A. C. BEST.

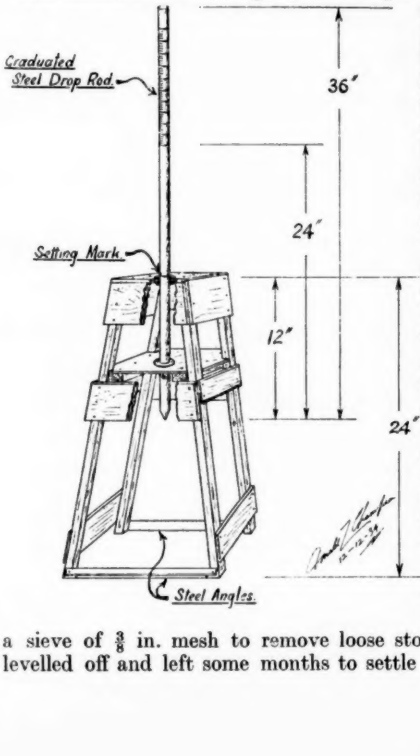
Meteorological Station, Croydon, October 10th, 1935.

NOTES AND QUERIES

Scalar Values of the State of the Ground

For some months past an attempt has been made to obtain scalar values of the hardness of the surface soil at Goff's Oak, Herts, and the results obtained may be of interest.

The instrument used, Fig. 1, is of simple construction, consisting of a mild steel drop rod $\frac{3}{4}$ in. in diameter, 36 in. in length, weighing $4\frac{1}{2}$ lbs. This rod is arranged to slide freely in a vertical plane through steel bushes let into a timber trestle. The trestle is fitted with steel angles at its base to minimise wear and is so constructed that the surface of the upper bush shall be fixed at 24 in. from the underside of the steel angles. The pointed drop rod has a setting mark engraved at a distance of 12 in. from the point and a scale of inches and tenths is engraved on the upper end, the zero mark being 12 in. from the setting mark.

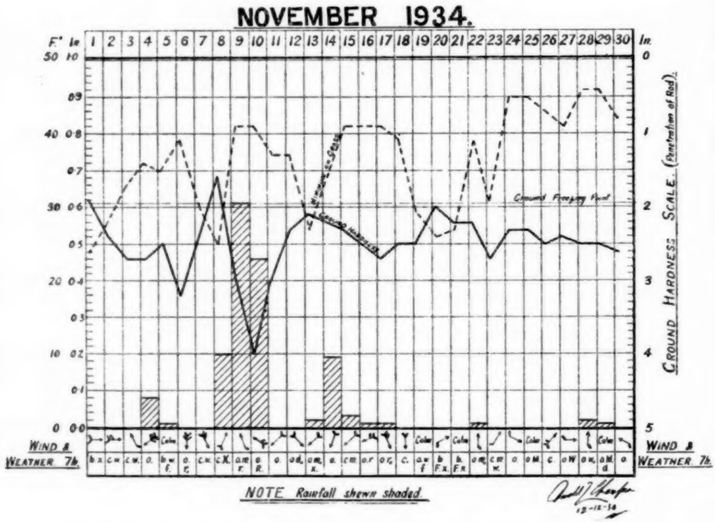


A patch of soil was dug out to a depth of 15 in., passed through a sieve of $\frac{3}{8}$ in. mesh to remove loose stones, replaced, carefully levelled off and left some months to settle and kept free of weeds.

The instrument is operated as follows. The trestle is placed on the prepared ground and the rod is raised so that the setting mark coincides with the plane of the upper surface of the top bush. The rod is then released, and falling into the soil, the depth of penetration of the point is read off from the scale, the upper surface of the top bush being the index. The hardness of the ground is taken as being inversely proportional to the depth of penetration. At first, the mean of three trials was taken as the correct reading, but after many observations it was found that the readings obtained from any three trials, made at the same time, differed but little from each other and the method was abandoned in favour of only one trial per observation.

The instrument is kept indoors when not in use and is placed in a different position for each observation to avoid piercing the soil in the same place each day. The area of the prepared soil is such that some considerable time elapses before the same spot is pierced, during which period the soil becomes automatically levelled again by the weather.

Since the height of the drop (12 in.) and the weight and diameter of the rod are constants, it follows that the readings from day to day give comparable values of the soil hardness.



The attached chart for the month of November 1934, Fig. 2, shows the penetration each day at 7h. G.M.T. in conjunction with the rainfall, grass minimum, wind and weather, etc. The grass minimum temperature (°F.) and rainfall (in.) in the preceding 24 hours are

shown by the scales on the left-hand side, the penetration of the rod in inches by the scale on the right-hand side. The effect of rainfall in softening the soil (Boulder Clay) is apparent throughout the month, particularly on the morning of the 10th ; but even light falls have effect if there is little wind to dry the surface as on the morning of the 23rd. The converse effect of frost is conspicuous on the mornings of the 8th and 20th.

This instrument gives fair results for clay soils, but probably other soils would become tamped down by continued use of the rod over a small area. However the curve shown in Fig. 2 demonstrates the fact that comparative results are obtainable from day to day at stations where the surface soil is clay or similar material.

DONALD L. CHAMPION.

The Dines Tilting Syphon Rain-gauge

In order that self-recording rain-gauges may give a continuous record during prolonged periods of heavy rain it is customary to provide them with an automatic syphoning device which empties the float chamber when the pen reaches the top of the chart. This syphoning device is a frequent cause of trouble and many attempts have been made to devise a system which shall be entirely reliable. Considerable complications have sometimes been introduced in this endeavour but it cannot be said that these complications have been altogether justified by the results obtained and of late years the tendency has rather been to rely upon a simple syphon, very careful attention being given to the design of the syphon tube to ensure that it shall function in a reliable manner. Modern gauges do not give much trouble in this way but from time to time the action does fail and in the endeavour to obtain an entirely satisfactory gauge much thought has been given to the design of self-recording rain-gauges in the Meteorological Office during the past few years. Experience shows that failure is most likely to occur when the rainfall is light. In these circumstances the column of water in the rising tube approaches the top of the syphon very slowly and may dribble over instead of " breaking " cleanly and abruptly. What is required therefore is some means of ensuring that the syphon will be started in a positive manner under all conditions.

Amongst the designs which came up for consideration was one by the late Mr. W. H. Dines in which the float chamber was mounted on knife edges which were so positioned that when the chamber became full it overbalanced on the knife edges, tilting over towards the side on which the syphon outlet tube was mounted. The tilting action caused a surge of water to flow through the tube which started the syphon in a positive manner thus fulfilling the requirement mentioned above. When the chamber emptied it fell back into its former position under the action of gravity and so was ready for a

repetition of the operation. This gauge was described in the *Meteorological Magazine* for July, 1920. Two or three gauges were made up in the workshop at Benson Observatory and were in use for several years and gave on the whole satisfactory results. It was found however that the point of tipping was somewhat irregular which made it difficult to measure up the charts. When this design was considered it was suggested by Sir George Simpson, Director of the Meteorological Office, that if the tilting of the float chamber were controlled by a catch, this catch being released by a trigger when the float reached a specified point, the action of the gauge would be rendered more regular. A gauge to which this additional device was fitted was accordingly made up at Kew Observatory and showed very satisfactory results in a prolonged test. Equally satisfactory results had not been obtained from other types of gauge which were under trial at the same time and it was, therefore, decided to concentrate attention on the Dines tilting syphon rain-gauge. Detailed drawings were prepared in the Instruments Division and six gauges purchased from Messrs. J. J. Hicks of Hatton Garden. These gauges have now been put through a thorough test and have confirmed the anticipations of satisfactory working which had been formed from the test on the experimental model. The design has therefore been adopted as the standard Meteorological Office pattern recording rain-gauge. A diagram showing the principle of the gauge is given in Fig. 1 together with a photograph of the completed gauge in Fig. 2; these form the frontispiece of this number of the magazine. The rule on the left in the photograph is a 2-foot rule from which it will be seen that the gauge is of somewhat massive proportions. This is due partly to the desire to make it as robust as possible and partly to the fact that an open scale record giving ten times the natural scale was desired. In order to obtain this scale it was considered expedient to fit a funnel of 11·31 in. diameter having an area twice that of an 8 in. funnel. The charts issued by the Meteorological Office are ruled for millimetres, the syphon operating after 5mm. of rain have fallen. Since 5 mm. differs little from 0·2 in. the gauge can be used without modification for charts ruled in inches, the adjustments which are provided being sufficient to enable syphoning to take place after 0·2 in. of rain instead of 5 mm. A description of the gauge appears in the 1934 edition of the "Meteorological Observer's Handbook", page 126.

REVIEWS

The cycles that cause the present drought. By Halbert P. Gillette. A paper read June 26th, 1935, at the Annual Meeting of the American Meteorological Society at Los Angeles, California.

This brief paper contains much food for thought. The author begins by analysing graphically a series of long records of growth

rings of Arizona pines (1410–1866) and of Sequoias from California (1305 B.C.–A.D. 216), and of thickness of the varves or annual clay-laminae formed by the recession of the last ice-sheet in Canada (1824 years), all of which show convincing evidence of a cycle of about 152 years. The same cycle appears in Nile flood levels from 1735 to 1919 and New England rainfall from 1750 to 1934, though as these two curves extend over less than two cycles the evidence is not so convincing.

These long series of data were then analysed for periodicities by an arithmetical summation method, and thirteen cycles were found, ranging in length from just under 2 years to 152 years 1 month. Generally speaking, the " amplitude " (defined as the percentage departure of the cyclograph peak or valley from the mean) increases with increasing length. This is probably due to the fact that the shorter the cycle the more often it is repeated during the period available, and hence the less chance there is of a spurious periodicity passing as real. The amplitude of the 2-year cycle is only 4 per cent, which is negligible, increasing to 15 per cent for the 69·7 year cycle and 13 per cent for that of 100·7 years. The author gives no confirmation of this part of his results, but further evidence is required before these cycles can be accepted as genuine, especially those which have not been found previously by rigid analysis of instrumental data. Cycles of 2, 3·1 and 23–24 years are already well known from many parts of the world. Curiously, the 11-year sunspot cycle is missing from the series.

The 152-year cycle, with a sudden jump in amplitude to 25 per cent is in a different category, and the graphs alone are sufficient proof. Moreover, the author finds support in historical data from California and Australia. He then introduces the idea that the amplitude of the cycles is not constant, but itself goes through a regular cycle which is several times the length of the basic cycle. Thus the 2-year cycle (35/18 years) has itself an amplitude cycle of 35 years, that of the 19/6-year cycle is 19 years and so on. The author does not state how these " amplitude cycles " were found, and the " fit " with the basic cycle expressed as a fraction is much too good to be true.

152 years 1 month is 1825 months, and hence it is inferred that this periodicity should have an amplitude cycle of 1825 years. The exact length of this major cycle depends on the odd month, but a little consideration should make it obvious that the true length may equally well be either 152·0 or 152 years 2 months giving inferred amplitude cycles of infinity or 913 years ! However, he adds, " Evidence of the correctness of this inference is to be found in groups of exceptionally high recessional moraines at intervals of about 1825 years ". Roughly the same interval is claimed for Finland. There seems no reason however why this long interval should not be an independent periodicity or recurrence, unrelated to the cycle of 152-years. In western Europe for example there is no evidence of a marked 152-year periodicity, but the two periods

of greatest storminess and rainfall appear to have been about 600 B.C. and A.D. 1,200.

From his results the author concludes that the recent droughts in America represent the troughs of the 152- and 69·7-year periodicities, and hence are likely to continue for many years, so that plans should be laid accordingly. Time will tell; meanwhile the author should present his data in much greater and more critical detail.

C. E. P. BROOKS.

Weather Studies, No. 1. *Unofficial Meteorology.* Lecture by Sir Napier Shaw, LL.D, Sc.D., F.R.S., at Falmouth, July 20th, 1933, on the occasion of the Centenary of the Royal Cornwall Polytechnic Society. Size 10 in. × 6 in., pp. 26. *Illus.* Huddersfield, Thunderstorm Census Organisation, 1934. 1*s.* net.

In re-issuing this lecture originally published in the *Hundredth Annual Report of the Royal Cornwall Polytechnic Society,* Mr. Morris Bower performs a service by introducing it to a wider public. The lecture is quite short but covers a range of subjects in Sir Napier's usual entertaining style. Particularly skilful is the presentation of certain salient facts of meteorology in a way that will ensure their being impressed on the memory of many a reader who may have often read and forgotten them in a duller setting. The value of the pamphlet is much enhanced by the power of the illustrations to grip the imagination. Among these we have a most useful pictorial summary of the results of upper air research, pictures of snow crystals and dust particles, diagrams relating to the weather elements at Falmouth and Kew, and above all a selection of exceedingly beautiful cloud photographs, many of them from Mr. Cave's collection. Yet we note with satisfaction that Sir Napier refers to the photographic camera not as one of the requisites but as one of the perquisites of unofficial meteorology. Photography is costly both in time and money, and however desirable as an adjunct should never take the place of the diligent use of the amateur meteorologist's own eyes. A meteorologist should notice everything when in the open air—even to the faintest suspicion of a shower far away on the horizon, and should aid a retentive weather memory by making notes and descriptions of what he observes.

A photograph of a walnut tree at Benson with its spring foliage injured by frost is stated to have been taken by the late Mr. W. H. Dines on May 31st, 1922. We query this date as it fell near, or within, the hottest spell of May weather on record. There may, of course, have been a localised valley frost capable of damaging foliage at that time, but the date is more likely to have been May 31st, 1923.

L. C. W. BONACINA.

[Severe frost was experienced at Benson on May 13th, 1922, when 25° F. was registered in the screen and 20° F. on the ground.—ED., *M. M.*]

Earthquakes and Mountains. By Harold Jeffreys, F.R.S. Size 7½ in. by 5 in., pp. x + 183. *Illus*. London, Methuen & Co., Ltd., 1935, 7*s*. 6*d*. net.

In the preface to this monograph we read that " This book has been written with the object of providing an account of the modern study of the Physics of the Earth in general language, for the benefit of those interested in natural phenomena and their causes. To a large extent it summarises my larger book " The Earth " (1929), but attention is given to much work that has been published later."

Geophysics embraces many branches of science on the borderland between mathematics, physics and geology, and the author neglects no opportunity of showing how the results obtained from the different sources are related. The first of the seven chapters is introductory giving an account of the mechanical properties of solids and fluids. The chapters on earthquakes, radioactivity and the earth's history, and on the mechanics of geology, are given considerably more space than those dealing with gravity and the shape of the earth, the strength of the earth, and the bodily tide and tidal friction.

The chapter on earthquakes is of great value as a supplement to G. W. Walker's " Modern Seismology",* which is still the standard English introduction to the subject but does not include the recent developments. This chapter contains in 35 pages descriptions of the causes leading up to the earthquakes, of the effects of the shocks upon buildings, of the various waves which are propagated over and through the earth, and of the instruments used to record these waves. The records not only serve to locate the shocks but yield information about the distribution and properties of the materials within the earth. The most important deduction of this kind is that the earth is not solid throughout, but that nearly 3,000 Km. below the surface an inner core is reached which is probably composed of a heavy metal in the liquid state.

In the descriptions of seismographs the author, perhaps, lays too much stress upon the need for a long free period. Such periods were required with earlier instruments which had only a moderate magnification, but in some modern types the magnification has been increased and shorter periods are practicable. It has been found that, even for distant earthquakes, certain features of the wave motion are brought out clearly by instruments with periods of about a second, but not by those with longer periods. Also, in pointing out that the bearing of an epicentre computed from two horizontal seismographs at any station is ambiguous by 180°, the value of the vertical component in discriminating between these directions is overlooked.

Throughout the whole work the results and theories are set out in a readable and attractive manner, and the book will be appreciated by geophysicists as well as by the more general reader for whom it was written. A. W. Lee.

* Monographs on Physics. Longmans, Green and Co., 1913.

Aerologische Beobachtungen und Terminbeobachtungen in Angmagssalik während des Internationalen Polarjahres, 1932–1933. K. Ned. Meteor. Inst. 106A. Ergebnisse Aerologischer Beobachtungen 22A. 's Gravenhage, 1934.

In addition to its aerological work at Reyjavik, Holland set up a magnetic and meteorological station at Angmagssalik, in east Greenland. This publication includes ground observations for the whole Polar Year, and 254 pilot balloon observations made in the summer of 1933. A noticeable feature is the large number of winds at high levels from some easterly point. At a height of 4 Km. the proportion was 68 out of 131, or 52 per cent, and at 8 Km. 35 out of 63, or 56 per cent. The higher percentage at 8 Km. was probably accidental, since 20 of the 35 east winds were in the period July 21st to 29th, but it is noteworthy that there was no case of an easterly component at 4 Km. being reversed higher up. Even above 2½ Km. there were only a few reversals, involving quite small vector changes of wind.

C. K. M. Douglas.

BOOKS RECEIVED

A statistical study of the maximum temperatures at Poona. By R. J. Kalamkar, Ph.D., India Meteor. Dept., Sci. Notes **5,** No. 59.

Erratum

October, 1935, p. 215, line 17. The formula should read :—

$$E = (1 \cdot 465 - 0 \cdot 0186B)(0 \cdot 44 + 0 \cdot 118W)(e_s - e_d).$$

The Weather for October, 1935

Pressure was below normal over Europe (except the south-west), south-west Asia, Greenland, the Arctic regions and most of south-western United States, the greatest deficits being 11·5 mb. at Lerwick and 0·7 mb. near Salt Lake City. Pressure was above normal elsewhere in North America, the southern North Atlantic, north-west Africa, and north-west Siberia, the greatest excesses being 11·0 mb. at Kodiak (Alaska), 8·5 mb. at Horta (Azores) and 9·0 mb. at Waigatz. In Sweden generally temperature was slightly, and rainfall considerably above normal.

The main features of the weather of October over the British Isles were the frequency and severity of the gales, the sunshine deficiency especially in Scotland, and the high minimum temperatures on many nights, especially on the nights of the 27th–28th and 28th–29th. Depressions moving across the country gave generally unsettled weather from the 1st–6th, with strong winds at times and gales on the 1st. The 1st was a generally sunny day, 10·1 hrs. bright sunshine were recorded at Falmouth and 9·2 hrs. at Ballinacurra (Co. Cork), but later though there were sunny intervals rain was widespread and heavy in places and thunderstorms were experienced locally on the 1st and 3rd to 6th ; 2·90 in. fell at Mary Tavy (Devon) on the 5th

and 1·76 in. at Inverness on the 4th. Mist or fog occurred at a few places. A wedge of high pressure on the 7th gave much sunshine generally that day, 10 hrs. at Weymouth, Bournemouth and Littlehampton, but this improvement was only temporary and from the 8th to 11th a depression crossing the country occasioned gales in the south and further heavy rain at times, 2·17 in. fell at Lligwy (Anglesey) and 1·92 in. at Holne (Devon) on the 9th, while thunderstorms were experienced locally. From the 11th to 17th pressure was high in the south, but the north came under the influence of depressions passing across Iceland to north Norway. In the north there was occasional rain and moderate winds increasing to gale force at times; in the south the 11th and 12th were sunny days, Ventnor, Worthing and Eastbourne each had 10 hrs. bright sunshine on the 12th, but after that the conditions were mainly mild and cloudy, with occasional slight rain. From the 18th–20th a depression passed eastwards across the Shetland Isles deepening considerably on the 19th so that strong winds and gales occurred in all parts of the country.* Fresh snow was reported on the mountains in Inverness on the 18th. In the rear of this depression the winds became northerly and snow was reported from many parts of Scotland and the Midlands on the 20th and 21st and hail in Ireland. From the 20th–26th temperature was low generally and frost was widespread. The night of the 20th–21st was markedly cold, a screen minimum of 23° F. being reported from Marlborough and Penrith, while the grass minimum fell to 13° F. at S. Farnborough. Fog also was prevalent in England from the 21st–26th, while over the country generally, light or moderate rain occurred at times, more frequently in the north and west, with some sunny intervals. During the night of the 26th temperature rose considerably and continued above normal until the end of the month. On the night of the 27th–28th, minimum temperatures did not fall below 58° F. at many places in the Midlands and south and east England; the following night also was almost as warm. During this time there was some rain most days with occasional gales at exposed places. Among the largest falls were 2·62 in. at Dungeon Ghyll (Westmorland) on the 28th and 1·90 in. at Lake Vyrnwy (Montgomery) on the 30th. Thunderstorms occurred locally in Scotland, north England and north Ireland on the 28th–31st. The distribution of bright sunshine for the month was as follows:—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ...	56	−23	Chester ...	77	−18
Aberdeen ...	80	−16	Ross-on-Wye ...	93	−7
Dublin	108	+11	Falmouth ...	102	−11
Birr Castle ...	78	−13	Gorleston ...	125	+8
Valentia... ...	77	−15	Kew	97	+4

* See p. 225.

Miscellaneous notes on weather abroad culled from various sources

Several sailing vessels were wrecked and 20 people drowned in a storm in the Black Sea about the 1st. Snow fell in abundance in Switzerland and Austria at the beginning of the month and most of the Alpine passes were blocked. Violent storms accompanied by heavy rain caused havoc in south-eastern France about the 4th and many rivers overflowed their banks while a landslip occurred near Vienne. Serious floods were experienced about the 8th near Klagenfurt (Carinthia) as the result of heavy rain which made the Drave overflow and washed away several bridges. A gale swept across Belgium and western Germany on the 10th. Persistent rains caused serious damage to the countryside in northern Italy during the first half of the month, and floods and landslides were reported from Venetia. The Alpine passes were reopened to traffic after the 4th but were almost all blocked again by the 22nd as snow had fallen down to 3,500 ft. Severe storms swept over Southern Italy on the 21st, 5 people were killed in the syracuse district and part of Naples was flooded. Snow had blocked the mountain passages between Andorra and France and between Spain and the valley of Aran by the 24th when snow was also falling in the Dolomites and other parts of northern Italy. A cloudburst on the 23rd near Simitli (Petritch, Bulgaria) caused two tributaries of the Struma to flood the railway and roads and 17 men were drowned. Torrential rain caused much damage in the Alps on the 29th. Gales were experienced in the Black Sea, Sea of Mamora and in the neighbourhood of Alexandria on the 30th, while a dense sandstorm occurred in the Suez Canal, and storms and heavy rains destroyed railway culverts in the Sinai desert. (*The Times*, October 2nd–November 2nd.)

Three people were killed when the Constantine-Algiers express left the rails near Chateaudun du Rhummel on the 11th, owing to a subsidence caused by heavy rain. (*The Times*, October 12th.)

The floods in northern Kiangsu and northern Honan continued to spread during the early part of the month while famine prevailed in southern Honan in consequence of drought. Brief but unprecedently heavy rain showers giving what was reported to be the heaviest total since the Observatory was established occurred in Tokyo on the 27th and parts of the town were flooded. (*The Times*, October 8th–28th.)

Heavy and widespread rain occurred generally in Australia about the 20th greatly improving the agricultural and pastoral prospects. (*The Times*, October 22nd.)

The first blizzard of the season lasting 2 days occurred in Alberta and Saskatchewan near the end of the month. Incessant rains and high winds occurred in Jamaica on the 20th and the eastern end of the island suffered severely. On the same day a hurricane struck southern Haiti causing widespread floods. Early on the 22nd this hurricane passed across the eastern end of Cuba, accompanied by torrential rain and the river Cauto overflowed but only one person was reported killed. Temperature was much below normal generally

over the United States except in the west at the beginning of the month but about the middle it was mainly above normal especially in the Mississippi Valley but below normal in the west. Rainfall was mainly deficient except locally later in the month. Copious rains in the cereal zone of the Argentine between the 13th and 16th brought the drought to an end but later the Parana and the rivers in Paraguay and Uraguay overflowed and many cattle were drowned. (*The Times*, October 17th–November 1st.)

Some severe gales were experienced in the North Atlantic.

Daily Readings at Kew Observatory, October, 1935

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp. Min.	Temp. Max.	Rel. Hum. 13h.	Rain.	Sun.	Remarks. (see vol. 69, 1934, p. 1).
	mb.		°F.	°F.	%	in.	hrs.	
1	998·0	SSW.3	47	58	72	trace	6·6	pr$_0$ during day, tl 15h.
2	996·0	SSW.3	43	57	73	0·09	1·5	r$_0$ 14h–21h.
3	985·9	S.3	47	54	78	0·30	1·7	r$_0$ 7h., r–r$_0$ 12h.–24h.
4	988·3	SE.2	50	59	86	0·28	3·4	r early, pr 11h.–23h.
5	994·5	SW.3	49	59	74	—	2·0	pr$_0$ 16h.
6	1006·3	NW.2	43	56	81	—	1·3	F early & late.
7	1014·3	SW.1	40	59	71	—	6·3	F early.
8	1005·2	SW.4	45	54	93	0·22	1·4	r 8h.–13h.
9	1006·8	SW.4	46	57	73	0·02	0·1	r$_0$ 2h.–3h. & 18h.–23h.
10	1003·2	W.5	55	58	50	0·45	7·3	r$_0$–r 0h.–8h.
11	1014·0	WNW.3	46	59	60	0·01	9·0	pr$_0$ 13h.
12	1023·9	W.2	39	57	63	—	8·7	
13	1027·2	SW.3	40	57	70	—	1·8	
14	1025·9	SW.2	49	60	84	—	0·1	
15	1025·3	SW.3	53	60	82	—	0·0	
16	1025·5	SW.3	55	62	83	trace	0·0	r$_0$ 23h.
17	1026·4	SW.3	49	60	68	—	4·9	d$_0$ early.
18	1025·6	W.2	47	58	64	—	3·8	
19	1000·8	W.5	50	55	44	0·04	8·1	r$_0$ 2h. & 5h.
20	1009·3	N.4	45	49	53	—	2·3	
21	1014·6	NNW.2	29	48	46	0·03	7·9	x early, r$_0$ 22h.–24h.
22	1012·4	NNE.2	39	48	72	0·01	0·2	r$_0$ 0h.
23	1010·6	S.3	35	52	53	—	8·6	x early.
24	1010·5	ESE.3	44	51	60	0·07	0·0	r$_0$ 2h.–7h., pr$_0$ 18h.
25	1016·4	N.3	42	52	53	—	7·6	Fx early.
26	1023·7	W.2	31	51	73	—	0·1	
27	1015·4	W.4	50	60	73	—	0·0	r$_0$ 13h.
28	1016·8	WNW.2	57	62	75	0·05	0·0	r$_0$ 19h.–22h.
29	1008·7	SW.4	56	60	73	—	0·4	r$_0$ 14h. & 23h.
30	1005·2	SW.5	42	54	65	—	0·9	pr$_0$ 21h.
31	995·9	SW.4	51	59	75	0·40	1·4	r3h.–6h., r-r$_0$13h.-18h.
*	1010·7	—	46	56	69	1·98	3·1	* Means or totals.

General Rainfall for October, 1935.

England and Wales ...	129	per cent. of the average 1881–1915.
Scotland	183	
Ireland	119	
British Isles	139	

Rainfall : October, 1935 : England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond	Camden Square	2·72	103	*Leics*	Thornton Reservoir	4·09	146
Sur	Reigate, Wray Pk. Rd.	4·08	123	,,	Belvoir Castle	3·08	114
Kent	Tenterden, Ashenden	4·14	119	*Rut*	Ridlington	3·03	108
,,	Folkestone, Boro. San.	4·03	...	*Lincs*	Boston, Skirbeck	2·57	94
,,	Eden'bdg., Falconhurst	4·50	125	,,	Cranwell Aerodrome	2·34	82
,,	Sevenoaks, Speldhurst.	3·67	...	,,	Skegness, Marine Gdns.	2·60	95
Sus	Compton, Compton Ho.	5·28	115	,,	Louth, Westgate	3·96	122
,,	Patching Farm	4·83	122	,,	Brigg, Wrawby St	3·39	...
,,	Eastbourne, Wil. Sq.	4·69	113	*Notts*	Worksop, Hodsock	...	...
,,	Heathfield, Barklye	5·11	123	*Derby*	Derby, L. M. & S. Rly.	3·47	133
Hants	Ventnor, Roy.Nat.Hos.	4·02	102	,,	Buxton, Terr. Slopes	10·12	206
,,	Fordingbridge, Oaklnds	6·61	159	*Ches*	Runcorn, Weston Pt	3·87	113
,,	Ovington Rectory	5·92	146	*Lancs*	Manchester, Whit. Pk.	5·24	159
,,	Sherborne St. John	4·08	116	,,	Stonyhurst College	10·84	241
Herts	Royston, Therfield Rec.	2·79	103	,,	Southport, Bedford Pk.	4·97	140
Bucks	Slough, Upton	2·59	93	,,	Lancaster, Greg Obsy.	6·66	162
,,	H. Wycombe, Flackwell	3·07	94	*Yorks*	Wath-upon-Dearne	3·53	127
Oxf	Oxford, Mag. College	3·69	132	,,	Wakefield, Clarence Pk.	4·65	162
Nor	Wellingboro, Swanspool	3·30	131	,,	Oughtershaw Hall	12·55	...
,,	Oundle	2·50	...	,,	Wetherby, Ribston H.	4·87	162
Beds	Woburn, Exptl. Farm	2·84	106	,,	Hull, Pearson Park	3·58	120
Cam	Cambridge, Bot. Gdns.	1·95	83	,,	Holme-on-Spalding	3·84	128
Essex	Chelmsford, County Lab	2·70	110	,,	West Witton, Ivy Ho.	5·04	135
,,	Lexden Hill House	2·42	...	,,	Felixkirk, Mt. St. John.	3·79	132
Suff	Haughley House	2·15	...	,,	York, Museum Gdns	4·80	178
,,	Campsea Ashe	3·04	116	,,	Pickering, Hungate	3·22	106
,,	Lowestoft Sec. School	2·30	82	,,	Scarborough	3·91	125
,,	Bury St. Ed., Westley H.	2·41	89	,,	Middlesbrough	3·78	126
Norf	Wells, Holkham Hall	3·79	135	,,	Baldersdale, Hury Res.	...	...
Wilts	Calne, Castle Walk	4·42	...	*Durh*	Ushaw College	3·77	110
,,	Porton, W.D. Exp'l. Stn	5·32	170	*Nor*	Newcastle, Town Moor.	4·07	127
Dor	Evershot, Melbury Ho.	5·62	122	,,	Bellingham, Highgreen	5·27	134
,,	Weymouth, Westham.	4·67	128	,,	Lilburn Tower Gdns	3·62	98
,,	Shaftesbury, Abbey Ho.	3·73	96	*Cumb*	Carlisle, Scaleby Hall	6·06	181
Devon	Plymouth, The Hoe	5·04	127	,,	Borrowdale, Seathwaite	24·50	215
,,	Holne, Church Pk. Cott.	7·33	111	,,	Borrowdale, Moraine	17·73	196
,,	Teignmouth, Den Gdns.	3·58	93	,,	Keswick, High Hill	10·36	185
,,	Cullompton	4·15	100	*West*	Appleby, Castle Bank	4·93	142
,,	Sidmouth, U.D.C.	3·69	...	*Mon*	Abergavenny, Larchf'd	3·96	94
,,	Barnstaple, N. Dev.Ath	6·44	142	*Glam*	Ystalyfera, Wern Ho.	9·70	141
,,	Dartm'r, Cranmere Pool	10·50	...	,,	Cardiff, Ely P. Stn	6·26	130
,,	Okehampton, Uplands.	7·64	127	,,	Treherbert, Tynywaun.	13·96	...
Corn	Redruth, Trewirgie	4·66	89	*Carm*	Carmarthen, The Friary	6·85	120
,,	Penzance, Morrab Gdn.	5·40	116	*Pemb*	St. Ann's Hd, C. Gd. Stn.	3·94	94
,,	St. Austell, Trevarna	5·79	110	*Card*	Aberystwyth	8·09	...
Soms	Chewton Mendip	5·39	112	*Rad*	BirmW.W.Tyrmynydd	9·33	141
,,	Long Ashton	6·34	168	*Mont*	Lake Vyrnwy	11·79	207
,,	Street, Millfield	4·39	135	*Flint*	Sealand Aerodrome	3·62	120
Glos	Blockley	3·36	...	*Mer*	Dolgelley, Bontddu	10·83	178
,,	Cirencester, Gwynfa	5·30	160	*Carn*	Llandudno	5·64	168
Here	Ross, Birchlea	3·80	115	,,	Snowdon, L. Llydaw 9	24·20	...
Salop	Church Stretton	5·19	143	*Ang*	Holyhead, Salt Island	4·72	118
,,	Shifnal, Hatton Grange	2·90	103	,,	Lligwy	8·36	...
Staffs	Market Drayt'n, Old Sp.	4·40	144	*Isle of Man*			
Worc	Ombersley, Holt Lock.	2·72	102		Douglas, Boro' Cem.	5·93	128
War	Alcester, Ragley Hall	3·30	120	*Guernsey*			
,,	Birminghm, Edgbaston	3·37	121		St. PeterP't.Grange Rd	4·46	99

Rainfall: October, 1935: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Wig .	Pt. William, Monreith.	6·64	168	*Suth* .	Melvich	6·86	187
„ .	New Luce School	8·18	176	„ .	Loch More, Achfary	17·96	230
Kirk .	Dalry, Glendarroch	8·89	169	*Caith* .	Wick	4·56	154
„ .	Carsphairn, Shiel	14·42	203	*Ork* .	Deerness	6·46	170
Dumf.	Dumfries, Crichton, R.I.	6·75	181	*Shet* .	Lerwick	6·35	161
„ .	Eskdalemuir Obs	10·38	192	*Cork* .	Caheragh Rectory	3·61	...
Roxb .	Hawick, Wolfelee	6·02	158	„ .	Dunmanway Rectory	3·52	59
Selk .	Ettrick Manse	8·57	156	„ .	Cork, University Coll	2·10	54
Peeb .	West Linton	8·25	...	„ .	Ballinacurra	2·06	51
Berw .	Marchmont House	4·43	116	„ .	Mallow, Longueville	3·22	89
E.Lot .	North Berwick Res	4·58	155	*Kerry*.	Valentia Obsy	4·89	88
Midl .	Edinburgh, Roy. Obs.	6·38	233	„ .	Gearhameen	9·30	101
Lan .	Auchtyfardle	8·00	...	„ .	Bally McElligott Rec	4·16	...
Ayr .	Kilmarnock, Kay Pk	8·13	...	„ .	Darrynane Abbey	5·15	102
„ .	Girvan, Pinmore	9·73	195	*Wat* .	Waterford, Gortmore	2·96	76
Renf .	Glasgow, Queen's Pk	10·16	312	*Tip* .	Nenagh, Cas. Lough	4·34	128
„ .	Greenock, Prospect H.	12·78	237	„ .	Roscrea, Timoney Park	4·03	...
Bute .	Rothesay, Ardencraig	11·38	...	„ .	Cashel, Ballinamona	3·39	94
„ .	Dougarie Lodge	8·80	...	*Lim* .	Foynes, Coolnanes	4·61	124
Arg .	Ardgour House	18·70	...	„ .	Castleconnel Rec	4·62	...
„ .	Glen Etive	...	...	*Clare* .	Inagh, Mount Callan	9·22	...
„ .	Oban	10·11	...	„ .	Broadford, Hurdlest'n.	4·23	...
„ .	Poltalloch	12·62	255	*Wexf* .	Gorey, Courtown Ho	3·23	91
„ .	Inveraray Castle	22·92	326	*Wick* .	Rathnew, Clonmannon.	2·30	...
„ .	Islay, Eallabus	11·28	236	*Carl* .	Hacketstown Rectory	2·97	78
„ .	Mull, Benmore	18·60	144	*Leix* .	Blandsfort House	3·48	99
„ .	Tiree	...	...	*Offaly*.	Birr Castle	3·88	133
Kinr .	Loch Leven Sluice	6·39	186	*Dublin*	Dublin, FitzWm. Sq	2·30	86
Perth .	Loch Dhu	17·10	239	„ .	Balbriggan, Ardgillan	...	...
„ .	Balquhidder, Stronvar.	15·19	...	*Meath*.	Beauparc, St. Cloud	3·38	...
„ .	Crieff, Strathearn Hyd.	6·18	157	„ .	Kells, Headfort	...	...
„ .	Blair Castle Gardens	5·63	182	*W.M* .	Moate, Coolatore	3·62	...
Angus.	Kettins School	4·68	148	„ .	Mullingar, Belvedere	4·26	137
„ .	Pearsie House	6·92	...	*Long* .	Castle Forbes Gdns	3·80	117
„ .	Montrose, Sunnyside	3·83	139	*Gal* .	Galway, Grammar Sch.	4·96	...
Aber .	Braemar, Bank	6·47	172	„ .	Ballynahinch Castle	7·93	132
„ .	Logie Coldstone Sch	...	...	„ .	Ahascragh, Clonbrock.	4·81	132
„ .	Aberdeen, King's Coll.	3·13	104	*Mayo*.	Blacksod Point	6·78	136
„ .	Fyvie Castle	3·95	103	„ .	Mallaranny	8·20	...
Moray	Gordon Castle	3·49	110	„ .	Westport House	7·81	173
„ .	Grantown-on-Spey	5·64	190	„ .	Delphi Lodge	14·09	148
Nairn.	Nairn	4·73	201	*Sligo* .	Markree Obsy	6·09	150
Inv's .	Ben Alder Lodge	9·64	...	*Cavan*.	Crossdoney, Kevit Cas.	4·30	...
„ .	Kingussie, The Birches.	7·67	...	*Ferm* .	Enniskillen, Portora	5·05	...
„ .	Inverness, Culduthel R.	7·63	...	*Arm* .	Armagh Obsy	3·33	122
„ .	Loch Quoich, Loan	...	...	*Down*.	Fofanny Reservoir	6·97	...
„ .	Glenquoich	...	...	„ .	Seaforde	3·73	105
„ .	Arisaig, Faire-na-Sguir.	8·35	...	„ .	Donaghadee, C. Stn	...	...
„ .	Fort William, Glasdrum	14·40	...	„ .	Banbridge, Milltown	2·98	108
„ .	Skye, Dunvegan	9·80	...	*Antr* .	Belfast, Cavehill Rd	6·05	...
„ .	Barra, Skallary	...	...	„ .	Aldergrove Aerodrome.	4·15	138
R&C .	Alness, Ardross Castle.	8·23	214	„ .	Ballymena, Harryville.	7·00	190
„ .	Ullapool	7·92	163	*Lon* .	Garvagh, Moneydig	6·70	...
„ .	Achnashellach	15·10	188	„ .	Londonderry, Creggan.	8·83	240
„ .	Stornoway	7·53	145	*Tyr* .	Omagh, Edenfel	5·33	145
Suth .	Lairg	6·26	168	*Don* .	Malin Head	7·82	...
„ .	Tongue	6·70	160	„ .	Killybegs, Rockmount.	5·64	...

Erratum: **Marchmont House, September, for 2·59/107 read 2·61/108.**

Climatological Table for the British Empire, May, 1935

STATIONS.	PRESSURE. Mean of Day M.S.L.	PRESSURE. Diff. from Normal.	TEMPERATURE. Absolute. Max.	TEMPERATURE. Absolute. Min.	TEMPERATURE. Mean Values. Max.	TEMPERATURE. Mean Values. Min.	TEMPERATURE. Mean Values. ½ Max. and Min.	TEMPERATURE. Mean Values. Diff. from Normal	TEMPERATURE. Mean. Wet Bulb.	Relative Humidity.	Mean Cloud Am'nt	PRECIPITATION. Am'nt.	PRECIPITATION. Diff. from Normal.	PRECIPITATION. Days.	BRIGHT SUNSHINE. Hours per day.	BRIGHT SUNSHINE. Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0–10	in.	in.			
London, Kew Obsy	1019·0	+ 3·1	74	30	59·5	44·1	51·8	− 1·6	44·7	77	6·7	1·39	− 0·33	10	6·1	40
Gibraltar	1014·2	− 1·9	79	51	70·4	55·6	63·0	− 2·5	55·2	83	5·2	4·70	+ 3·13	11	...	...
Malta	1014·2	− 0·3	83	56	69·1	59·9	64·5	− 1·4	58·9	74	5·5	0·00	− 0·41	0	8·6	62
St. Helena	1013·6	+ 0·4	74	57	66·1	58·9	62·5	− 0·6	59·8	93	9·4	3·41	...	27	...	...
Freetown, Sierra Leone	1013·5	+ 2·3	92	68	87·2	74·4	80·8	− 0·7	76·4	80	7·2	10·83	− 0·64	16	...	...
Lagos, Nigeria	1011·3	+ 0·7	89	72	87·1	76·3	81·7	− 0·1	77·3	85	8·3	13·99	+ 3·24	16	6·3	51
Kaduna, Nigeria	1007·4	...	99	66	89·8	70·7	80·3	+ 0·9	73·0	78	6·7	8·02	+ 2·32	13	8·2	65
Zomba, Nyasaland	1014·6	− 0·5	86	56	76·0	59·4	67·7	+ 1·9	61·4	73	5·4	0·72	− 0·32	4	...	...
Salisbury, Rhodesia	1017·2	− 1·1	81	36	73·6	48·2	60·9	+ 0·3	53·9	59	1·1	1·41	+ 0·93	3	9·3	82
Cape Town	1018·8	+ 0·7	86	39	67·9	51·2	59·5	+ 0·6	52·0	86	3·9	3·71	− 0·04	9	...	...
Johannesburg	1018·8	− 0·9	73	28	62·8	43·0	52·9	− 1·5	44·7	61	3·1	0·17	− 0·59	2	8·5	78
Mauritius	...	...	82	59	79·0	66·4	72·7	+ 0·1	68·4	72	4·8	1·41	− 1·62	12	7·1	63
Calcutta, Alipore Obsy.	1002·0	− 1·5	108	75	99·8	81·5	90·7	+ 4·6	80·7	77	4·7	0·42	− 5·14	3*	...	...
Bombay	1007·5	+ 0·1	94	75	91·3	79·3	85·3	− 0·5	77·3	75	3·9	0·00	− 0·55	0*	...	...
Madras	1003·7	− 1·7	109	75	100·4	82·5	91·5	+ 1·7	79·0	61	5·6	0·00	− 1·84	0*	...	...
Colombo, Ceylon	1008·9	+ 0·5	90	71	87·1	78·1	82·6	− 0·2	79·0	79	8·0	14·18	+ 3·24	23	5·9	48
Singapore	1008·6	− 0·1	90	71	85·9	75·7	80·8	− 1·2	77·8	84	7·7	6·84	+ 0·20	17	5·9	49
Hongkong	1008·6	− 0·5	89	68	82·3	74·3	78·3	+ 0·9	73·8	79	7·4	4·73	− 7·34	13	4·6	35
Sandakan	1008·8	...	92	73	89·8	75·5	82·7	+ 0·2	77·5	81	6·2	8·48	+ 2·15	14	...	...
Sydney, N.S.W.	1019·6	+ 1·0	77	45	66·8	49·9	58·3	− 0·5	52·7	73	4·8	2·07	− 3·11	11	6·7	65
Melbourne	1020·5	+ 1·3	70	36	60·6	44·9	52·7	− 1·4	48·4	79	6·2	1·56	− 0·60	15	4·0	40
Adelaide	1021·3	+ 1·3	77	41	64·2	48·5	56·3	− 1·6	51·0	70	6·9	2·58	− 0·20	17	4·4	43
Perth, W. Australia	1019·1	+ 0·7	83	46	70·9	54·4	62·7	+ 2·0	55·1	64	4·9	4·52	− 0·45	16	6·0	58
Coolgardie	1019·0	− 0·4	87	38	72·0	46·4	59·2	+ 1·5	52·7	59	4·5	0·12	− 1·21	3	...	...
Brisbane	1016·2	− 2·4	78	43	73·5	52·6	63·1	− 1·5	56·2	65	2·8	1·55	− 1·26	5	8·1	76
Hobart, Tasmania	1016·8	+ 1·5	64	36	56·1	43·1	49·6	− 0·9	44·9	77	6·2	0·87	− 1·03	15	4·0	41
Wellington, N.Z.	1015·3	− 0·3	64	37	55·6	45·4	50·5	− 2·3	47·6	77	6·0	3·50	− 1·18	19	4·4	44
Suva, Fiji	1013·1	+ 0·4	87	68	81·1	71·7	76·4	− 0·1	71·4	81	6·8	8·94	− 1·13	23	4·8	43
Apia, Samoa	1011·0	− 0·1	87	71	84·9	74·3	79·6	+ 1·2	76·1	80	5·6	4·84	− 1·23	14	7·1	62
Kingston, Jamaica	1013·1	0·0	90	75	87·1	72·2	79·7	0·0	71·8	71	1·5	0·23	− 4·16	3	7·0	54
Grenada, W.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	1017·0	+ 2·1	79	32	61·1	42·8	51·9	− 1·9	45·0	65	4·4	1·70	− 1·09	8	8·9	61
Winnipeg	1019·4	+ 5·6	79	30	61·6	39·9	50·7	− 1·3	40·3	70	5·4	1·72	− 0·28	8	8·1	53
St. John, N.B.	1010·9	− 3·0	68	32	56·4	40·1	48·3	+ 0·6	43·3	69	5·9	1·34	− 2·37	11	6·9	46
Victoria, B.C.	1018·6	+ 1·9	70	43	61·3	46·2	53·7	+ 0·7	49·4	73	4·3	0·26	− 0·87	7	10·8	71

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

(28744) Wt. 18/32 1050 11/35 Hw. G.377

*For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

St. John, N.B.	1010·9	− 3·0	68	32	56·4	40·1	48·3	+ 0·6	43·3	69	5·9	1·34	− 2·37	11	6·9	46
Victoria, B.C.............	1018·6	+ 1·9	70	43	61·3	46·2	53·7	+ 0·7	49·4	73	4·3	0·26	− 0·87	7	10·8	71

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.